A discretize-then-optimize approach for PDE-constrained shape optimization problems

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In the traditional approach to algorithmic PDE-constrained shape optimization, one derives a formula for the shape derivative (involving an adjoint PDE) either in volume or boundary formulation, then converts it into a shape gradient (vector field), which drives the transformation of the current into an updated domain. When implementing a discrete version of this procedure, the mesh quality often degrades.

In this talk, we propose a fully discrete approach to PDE-constrained shape optimization. We define a finite dimensional manifold of discrete shapes represented by computational meshes and perform mesh updates along the geodesics of a complete Riemannian metric. This procedure avoids mesh degradation by design. Numerical examples will be included.

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